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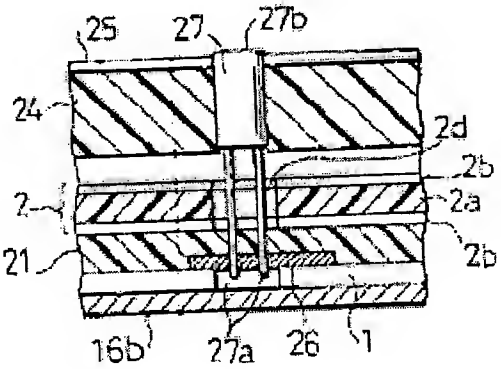
54 – Controller display board

A controller display board (15) is disclosed which has an electroluminescent element (1) for overall illumination of operating regions such as a thin-film switch (2) of the controller display board (15) as well as smaller light-emitting elements (27) for partial illumination of a display region of a switch (17, 18) which has been operated, and a wiring board (26) for supplying the respective light-emitting element (27) with electric current. The controller display board (15) is constructed from an electroluminescent element (1) and a thin-film switch (2) which is located above said element (1) and is formed from two light-conducting, insulating flat elements (2b) and from a pair of electrodes (2c) which are arranged on the insulating flat elements (2b), the light-emitting element (27) being arranged on the operating side of the thin-film switch (2) and having a smaller illumination area than the electroluminescent element (1), and a wiring board (26) being arranged between the electroluminescent element (1) and the thin-film switch (2).



[Letterhead: Klunker, Schmitt-Nilson, Hirsch]

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CONTROLLER DISPLAY BOARD

Claims

1. A controller display board whose front side defines an operating area,
characterized in that
- an electroluminescent element (1) is provided over which a thin-film switch (2) is arranged,
- the thin-film switch (2) is formed from two light-conducting, insulating flat elements (2b) and from a pair of electrodes (2c) which are arranged on the insulating flat elements (2b),
- a light-emitting element (27) is arranged on the operating side of the thin-film switch (2),
- the light-emitting element (27) has a smaller illumination area than the electroluminescent element (1), and
- a wiring board (26) arranged over the electroluminescent element (1) is provided for supplying electric current to the light-emitting element (27).

2. The controller display board according to claim 1,
characterized in that the light-emitting element (27) is a light-emitting diode and that the

light-emitting element (27) is embedded in a light-conducting spacer (24) which is arranged on the operating side[1] of the thin-film switch (2).

3. The controller display board according to claim 1 or 2,
characterized in that the wiring board (26) for supplying electric current to the light-emitting element (27) is formed from a light-conducting material and that the board (26) is arranged between the electroluminescent element (1) and the thin-film switch (2).

[1] Translator's note: A line of text was repeated here at the page break. The error is ignored in the translation.

Controller display board

The present invention relates to a controller display board and particularly to a controller display board, which is equipped with illumination functions.

Hitherto, there have been two types of controller display boards having illumination functions: one type with an overall illumination function and the other type with a partial illumination function.

An example of a form already realized having a partial illumination function is shown in the partial sectional view in Fig. 5. In this controller display board, a plate-shaped electroluminescent element 1 is rigidly arranged on a rear plate 4 to illuminate the entire board, and on the electroluminescent element 1 a thin-film switch 2 is arranged. The thin-film switch 2 has a pair of transparent, insulating flat elements 2b which are arranged such that they are turned towards one another, an insulating spacer 2a being arranged between the flat elements 2b and electrodes 2c being arranged on the areas [surfaces] of the insulating flat elements 2b turned towards one another. On the upper surface of the thin-film switch 2 or rather the surface of the switch 2 away from the electroluminescent element 1, a display flat element 3 is arranged. The surface of the display flat element 3 is colored to be non-transparent or semi-transparent, except for the region lying over the operating point of the thin-film switch 2, where some characters, digits or symbols are designed to be colorless or decolored.

If the electroluminescent element 1 emits light, the light is transmitted through the thin-film switch 2 and the light illuminates the entire display flat element 3, the result being that the colorless characters or the like provided in the display flat element 3 are illuminated or rather appear as illuminated characters or the like.

An example of a form already realized having a partial illumination function is shown in the partial sectional view in Fig. 6 in which the controller display board is intended to illuminate only one switch 6 or the like. The pushbutton 6, movable back and forth, is

formed from a light-conducting material and is arranged such that it protrudes from a board cover 5. On the rear side of the board cover 5, a light-conducting plate 7 is provided in which a light-emitting element 8 such as a light-emitting diode is embedded. The light-emitting element 8 is arranged laterally from the pushbutton 6 and thus, after the light-emitting element 8 is switched on, the light emitted by it is conducted through the light-conducting plate 7 and illuminates the pushbutton 6. The pushbutton 6 is equipped with a contact 9, which is rigidly arranged on the bottom area of the same, and below the contact 9 a pair of opposite lying electrodes 10a is arranged. The opposite lying electrodes 10a are mounted on a plate 10, and supply leads 8a of the light-emitting element 8 are soldered on the plate 10. The pushbutton 6 is prestressed using a plate spring 11 in the upward direction or rather in the direction away from the plate 10.

As was described above, the previously realized forms of controller display boards are designed fairly differently in terms of their basic construction, this being dependent on whether the controller display board is configured for overall illumination or for partial illumination. It was considered difficult to create a controller display board, which is equipped with both an overall illumination function as well as a partial illumination function. In practical terms, however, a controller display board equipped with both functions is desirable. For example, consider the example of a controller board or rather an operating panel for a car radio. When driving a car at night, it is desirable to have both an overall illumination function to illuminate the overall area of the controller board as well as a partial illumination function to bring out an operated region of the controller board. If illumination mechanisms constructed differently according to the previously realized forms are installed independently of one another in such a controller board, difficulties would arise both with regard to the arrangement of the operating parts as well as with regard to the design intended to achieve a pleasing appearance.

In view of the difficulties and problems named above with the previously realized forms, one object of the present invention is in the creation of a controller display board having a simple construction which is equipped with both an overall illumination function as well as a partial illumination function and which can be manufactured with a smaller size as

well as a smaller thickness and which, moreover, can be designed such that it offers excellent functioning as well as a pleasing appearance.

This objective is solved by the characterizing part of claim 1.

The controller display board according to the present invention has a thin-film switch, which is formed from a pair of electrodes, which are arranged on two light-conducting, insulating flat elements, the thin-film switch being arranged such that it lies over an electroluminescent element. On the operating side of the thin-film switch, a light-emitting element such as a light-emitting diode is provided which element has a smaller illumination area than the electroluminescent element. A wiring board formed from a light-conducting material for supplying the light-emitting element with electric current is arranged such that it lies between the electroluminescent element and the thin-film switch. The controller display board according to the invention is formed such that if the operating regions of the thin-film switch and the like are fully illuminated by the light emanating from the electroluminescent element, the display etc. for the operated region is additionally partially illuminated by the light-emitting element and thus emphasized.

According to the present invention, the following effects are obtained:

(1) Since the controller display board according to the invention is equipped with an electroluminescent element which produces illumination by means of a light-conducting thin-film switch as well as with light-emitting elements arranged on the operating side of the thin-film switch such as a light-emitting diode, the operating region of every thin-film switch can be fully illuminated by the electroluminescent element and moreover can be partially illuminated and emphasized by the light-emitting element. If the present invention is used in a controller board for a device to be used at night such as a car radio, the entire controller board is thus clearly illuminated and moreover the operated region such as a switch is clearly displayed and emphasized, thereby considerably improving the operational efficiency of the

device.

(2) Since the controller display board according to the invention is equipped with an electroluminescent element as well as with a wiring board for supplying the light-emitting elements with electric current, etc., the wiring system can be arranged in a compact manner whereas the entire body of the controller display board can nevertheless be designed to be very thin.

The invention thus creates a controller display board which has an electroluminescent element for overall illumination of operating regions such as a thin-film switch of the controller display board as well as smaller light-emitting elements for partial illumination of a display region of an operated switch and a wiring board for supplying the respective light-emitting element with electric current. The controller display board is built from an electroluminescent element and a thin-film switch lying over it which thin-film switch is formed from two light-conducting, insulating flat elements as well as from a pair of electrodes which are arranged on the insulating flat elements, the light-emitting element being arranged on the operating side of the thin-film switch and having a smaller illumination area than the electroluminescent element and a wiring board being arranged between the electroluminescent element and the thin-film switch.

Preferred further developments of the invention ensue from the dependent claims.

The invention and further developments of the invention are explained in greater detail hereafter based on schematic representations of an exemplary embodiment. The figures are as follows:

Fig. 1 A sectional view along line I-I from Fig. 4;
Fig. 2 A sectional view along line II-II from Fig. 4;
Fig. 3 A sectional view along line III-III from Fig. 4;
Fig. 4 A top view of a controller display board according to the invention;

Fig. 5 A sectional view of a previously realized form of an illuminated display board for the overall illumination of a display region; and

Fig. 6 A sectional view of a previously realized form of an illuminated display board for the partial illumination of a display region.

A preferred embodiment of the invention will now be described with reference to Figs. 1 to 4.

In the drawings, the reference number 15 designates a controller display board, which is accommodated in a housing 16. As is shown in Fig. 3, the housing is formed from a housing part 16a which covers the lateral regions as well as the upper boundary regions of the controller display board 15 as well as from a bottom plate 16b which covers the bottom area of the controller display board 15. A power switch 17, various operating switches 18, a volume slider 19, an LED display 20 for displaying the time, etc. are arranged on the display area of the controller display board 15.

As is shown in Figs. 1 and 2, a plate-shaped electroluminescent element forms the lowest layer of the controller display board 15. A wiring board 26 lies over the electroluminescent element 1. The wiring board 26 is formed from a light-conducting, transparent or semitransparent plastic plate or rather from a light-conducting, transparent or semitransparent plastic flat element and is provided with a predetermined conductor pattern, which is imprinted on the board.

A first insulating spacer 21 is placed over the wiring board 26, which spacer 21 is formed from a light-conducting material. Since the wiring board 26 is intended only for supplying current to those locations where current is required, it can have cut-out or rather punched-out regions in all other locations, and in these cut-out regions the first spacer 21 is in direct contact with the electroluminescent element 1, as is seen in Fig. 1.

A thin-film switch 2 is provided over the insulating spacer 21. The thin-film switch 2 is formed from a pair of light-conducting, insulating flat elements 2b which are turned

towards one another, from electrodes 2c separated from one another which are arranged on the areas [surfaces] of the insulating flat elements 2b turned towards one another, as well as from a light-conducting, insulating spacer 2a which is arranged between the two insulating flat elements 2b. The electrodes 2c are formed preferably from a transparent material, but they can also be formed from a material having low transparency such as silver paste, in which case, however, the electrodes should be formed in a ring or comb shape in order to allow light to pass. The electrodes 2c are arranged under the operating switches 18 and the power switch 17 shown in Fig. 4.

A second light conducting, insulating spacer 24 is provided over the thin-film switch 2. Between the second insulating spacer 24 and the thin-film switch 2, a space is formed at the location, which corresponds to each of the switches 17, 18. A concavely formed plate or plate spring 22 is provided in this space, as can be seen in Fig. 1. In the middle of the upper region of the plate spring, a hole 22a is provided which lies opposite the electrodes 2c of the thin-film switch located below. The bases or rather feet of the plate spring 22 are located on the flat element 2b at locations, which lie above the insulating spacer 2a.

In the second insulating spacer 24, a pushbutton 23 is restrained so as to allow movement back and forth. On the bottom area of the pushbutton, a projection 23a is formed which is adapted to the hole 22a provided in the upper region of the plate spring 22. The pushbutton 23 is formed from a light-conducting plastic material. The lateral circumferential areas of the pushbutton 23 as well as the upper surface of its operating region 23b are provided with a non-transparent or semitransparent coloring. However, in the operating region 23b, colorless or rather decolored regions are provided which allow light to pass. In the case of the power switch 17, for example, this means that the letters "POWER" are formed in a colorless manner, or in the case of a further switch 18, that a predetermined set of letters or the like are formed in a colorless manner so that the light passes through the letters (Fig. 4). And vice versa, a labeling in the form of non-transparent letters such as the word "POWER" can also be provided on the operating region 23b so that only the labeled region blocks the light while the remaining area of the pushbutton 23 allows the light to pass.

On the top side of the second spacer 24, a display flat element 25 is arranged, and the operating region 23b of the pushbutton 23 is formed so that it protrudes from the display flat element 25. The display flat element 25 is arranged so that it covers the overall display area of the controller display board 15. The display flat element 25 is formed from a light-conducting material and is provided on its surface with a non-transparent or semitransparent coloring. Moreover, the display flat element 25 is provided on its surface with multiple colorlessly formed characters, as shown in Fig. 4, the characters FM1, AM1, etc. representing channel display numbers in the drawings, and the colorless regions being configured so as to pass the light. The display flat element 25 and the pushbutton 23 can have either different coloration or the same color coloration.

Light-emitting elements 27 such as light-emitting diodes are embedded in the second insulating spacers 24. The light-emitting elements 27 are arranged along the different operating switches as well as next to the characters such as "FM1". As shown in Fig. 2, leads 27a of each light-emitting element 27 extend through a thru-hole 2b provided in the thin-film switch 2 and are connected to the wiring board 26 by means such as soldering material.

As shown in Fig. 3, the LED display area 20 (which contains light-emitting diodes) is also connected to the wiring board 26. A resistance element for each slider 19 is formed in the layer of the thin-film switch 2 by pressing [imprinting], e.g., on the insulating flat element 2b.

As shown in Fig. 4, these wiring elements, such as a flexible film 30 for connecting leads connected to the different switches 17, 18 and the adjusters 19, as well as leads 31 connected to the electroluminescent element 1, are fed outside through a side of the housing member 16a.

The functioning of the controller display board built in the manner described above shall now be described as follows.

When the electroluminescent element 1 emits light, a part of the light is conducted through the insulating flat elements 2b as well as through the electrodes 2c provided in the form of a ring or the like of the thin-film switch 2 to the projection 23a formed on the bottom area of the pushbutton 23. Since the pushbutton 23 conducts light, the pushbutton 23 is completely illuminated by the light. As a result of this, e.g., in the case of the power switch 17, the colorless letters "POWER" which are situated on the upper surface of the operating region 23b of the pushbutton are illuminated in a clearly visible manner.

If the light-emitting element 27 is switched on, the light-emitting element 27 itself and the characters such as "FM1" imprinted in its vicinity are partially illuminated. In other words, in the case in which the characters such as "FM1" are formed by a decoloring treatment, a part of the light emanating from the activated electroluminescent element 1 is conducted through the first insulating spacer 21, the thin-film switch 2 as well as through the second insulating spacer 24 in order to illuminate the characters from the inside. If simultaneously the light-emitting element 27 is switched on, a part of the light from the light-emitting element is conducted into the second insulating spacer 24 which results in the corresponding characters such as "AM1" being emphasized and standing out more clearly.

Moreover, the light-emitting element 27 can after its activation also illuminate a display such as the channel number by itself.

If the pushbutton 23 for the switch 17, 18 is pressed down, the pushbutton 23 is made to move downwards against the spring force of the plate spring 11, which results in the projection 23a being pressed against the upper insulating flat element 2b of the thin-film switch 2. As a result of this, the insulating flat element 2b is bent and the electrode 2c situated thereupon is brought into contact with the other electrode 2c, which is situated on the other or rather the lower flat element 2b. The switch is operated in this manner as an ON/OFF switch.

By pressing the buttons 19a of the individual sliders 19, the volume, the tone or the loudspeaker balance can be set independently.

An arrangement is also possible in which the display flat element 25 is not provided with a non-transparent coloring on its surface; instead, in this arrangement the overall display flat element 25 is illuminated by the electroluminescent element 1.

If the thin-film switch 2 is formed so that it can be pressed directly to operate it, there is no need for a pushbutton 23 and a plate spring 11.

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ORIGINAL INSPECTED

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Fig.1

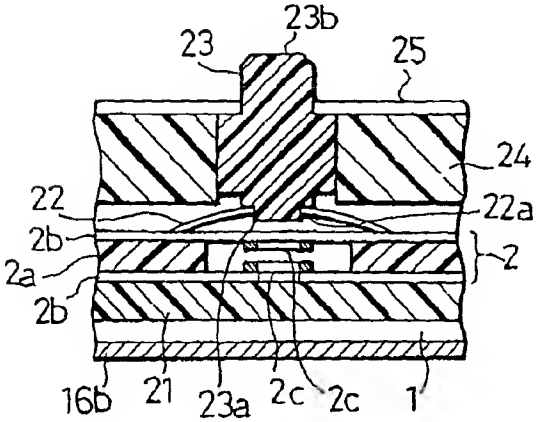

Fig.2

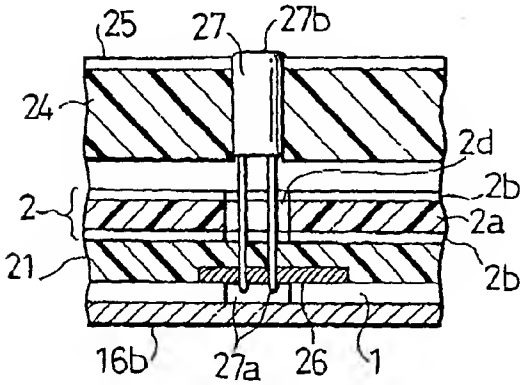

Fig.3

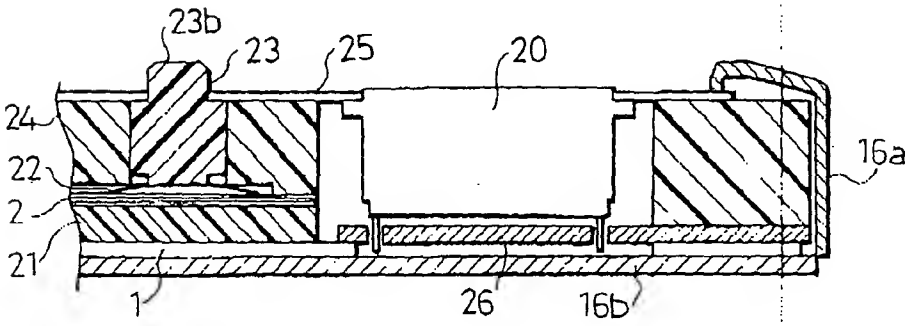

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Fig.4

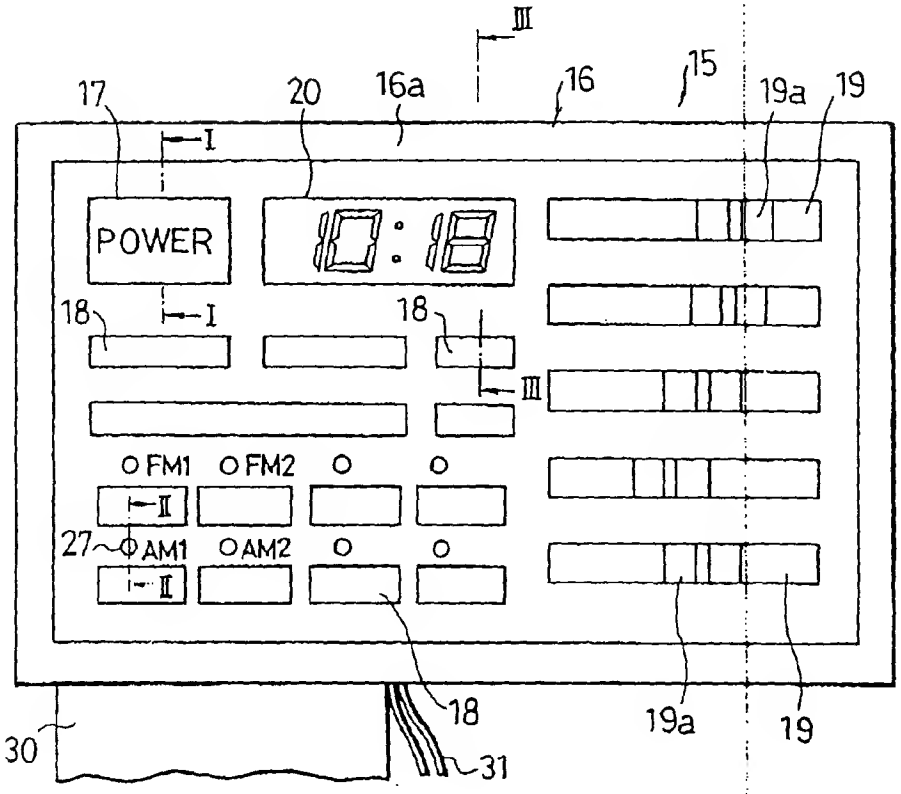

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Fig.5

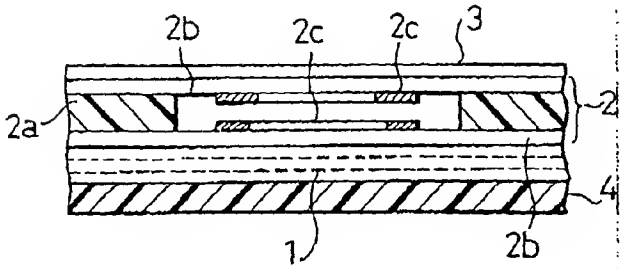

Fig.6